

CLAIMS

What is claimed is:

- 5 1. A method of rate and power control in a communication system comprising:
 - assigning a target channel condition metric to be met at a first communication terminal for signaling received from each of one or more remote communication terminals of the communication system, each
 - 10 communication terminal supporting a plurality of rates and a plurality of transmit power levels, each target channel condition metric based upon the type of service supported by each of the one or more remote communication terminals;
 - 15 receiving a signal at the first communication terminal from each of the one or more remote communication terminals; and
 - adjusting a respective target channel condition metric assigned for a respective one of the one or more remote communication terminals in response to signal information generated from the received signal from the respective one of the one or more remote communication terminals.
- 20 2. The method of Claim 1 further comprising determining a respective transmit power level and a respective rate that will satisfy the target channel condition metric for each of the one or more remote communication terminals, the respective transmit power and the respective rate to be used by a respective one of the one or more remote communication terminals for a respective subsequent signal to be transmitted from the respective one of the one or more remote communication terminals to the first communication terminal.

3. The method of Claim 2 wherein a respective signal received from a respective one of the one or more remote communication terminals was transmitted using a respective one of the plurality of rates and wherein the respective rate that satisfies a respective target channel condition metric 5 comprises a different one of the plurality of rates, the method further comprising:

measuring a channel condition metric corresponding to each received signal; and

10 setting the respective rate to the respective one of the plurality of rates rather than the different one of the plurality of rates, in the event the measured channel condition metric for the respective received signal is within a hysteresis threshold of the target channel condition metric and in the event the system has been transmitting using the respective one of the plurality of rates for less than a specified number of iterations of the receiving and 15 determining steps.

20 4. The method of Claim 2 further comprising transmitting the respective transmit power level and the respective rate for each of the one or more remote communication terminals to the respective one of the one or more remote communication terminals.

25 5. The method of Claim 2 wherein the determining step comprises solving, for each of the one or more remote communication terminals, the following equations for the respective transmit power level $p_i(n+1)$ and the respective rate $r_i(n+1)$ to be used by the respective one of the one or more remote communication terminals for the respective subsequent signal to be transmitted from the respective one of the one or more remote communication terminals to the first communication terminal:

$$p_i(n+1) = \max_{k \in \{1, \dots, L\}} \left\{ p_i(n) \frac{\gamma_i^k}{\gamma_i(n)} \mid \forall k : p_i(n) \frac{\gamma_i^k}{\gamma_i(n)} < p_{\max} \right\}$$

and

$$r_i(n+1) = \max_{k \in \{1, \dots, L\}} \left\{ r_i^k \mid p_i(n) \frac{\gamma_i^k}{\gamma_i(n)} < p_{\max} \right\}$$

5 where γ_i^k is the target channel condition metric for a given remote communication terminal, $\gamma_i(n)$ is the measured channel condition metric for a signal received from the given remote communication terminal, $p_i(n)$ is a transmit power level of the received signal from the given remote communication terminal, i is a terminal index of the one or more remote communication terminals, where $i=1,2,3,\dots,I$, where $I \geq 1$ and is a total number of the one or more remote communication terminals, k is a rate index where $k=1, 2, 3, \dots, K$, where K is a total number of the plurality of rates, and L is a highest rate of the plurality of rates supportable during the n^{th} iteration.

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15 6. The method of Claim 2 wherein the adjusting step comprises reducing the respective target channel condition metric assigned for the respective one of the one or more remote communication terminals in the event the respective transmit power level exceeds a maximum transmit power of the respective one of the one or more remote communication terminals.

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7. The method of Claim 2 wherein the adjusting and determining steps are performed at the first communication terminal, wherein the first communication terminal and the one or more remote communication terminals comprise a cell within a communication system comprising a plurality of cells, the adjusting and determining steps performed independent of rate and power adjustments made in others of the plurality of cells in the communication system, wherein a distributed rate and power control algorithm is provided.

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8. The method of Claim 1 wherein the adjusting comprises
adjusting the respective target channel condition metric in response to the
signal information generated from the received signal from the respective one
5 of the one or more remote communication terminals, the signal information
comprising one or more of a group consisting of: a measured channel
condition metric corresponding to the received signal, a measured received
signal strength of the received signal, and the results of an error detection
process performed on the received signal.

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9. The method of Claim 1 wherein the adjusting step comprises
reducing the respective target channel condition metric in the event a
measured received signal strength of the received signal from the respective
one of the one or more remote communication terminals exceeds a threshold
15 measured received signal strength of the first communication terminal.

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10. The method of Claim 9 further comprising:
measuring a channel condition metric corresponding to each
received signal; and

measuring a received signal strength for each received signal.

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11. The method of Claim 1 wherein the adjusting step comprises
reducing the respective target channel condition metric in the event an error
detection process indicates that there is an error in the received signal from
the respective one of the one or more remote communication terminals.

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12. The method of Claim 1 wherein the adjusting step comprises
increasing the respective target channel condition metric in the event an error
detection process indicates that there are no errors in the received signal from
the respective one of the one or more remote communication terminals.

13. The method of Claim 1 wherein at least two of the one or more remote communication terminals supports a different one of a plurality of types of service.

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14. A rate and power control device for a communication terminal of a communication system comprising:

a rate and power control module for performing the following steps:

10 obtaining an assigned target channel condition metric to be met at a first communication terminal for a signal received from each of one or more remote communication terminals, each communication terminal supporting a plurality of rates and a plurality of transmit power levels, the assigned target channel condition metric based upon the type of service

15 supported by each of the one or more remote communication terminals; and

adjusting a respective assigned target channel metric for a respective one of the one or more of remote communication terminals in response to signal information generated from the signal received from the respective one of the one or more remote communication terminals.

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15. The device of Claim 14 further comprising an integrated circuit device, the rate and power control module implemented within the integrated circuit device.

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16. The device of Claim 14 wherein the rate and power control module additionally performs the following step:

determining a respective transmit power level and a respective rate that will satisfy the assigned target channel condition metric for each of the one or more remote communication terminals, the respective transmit power and the respective rate to be used by a respective one of the one or

more remote communication terminals for a respective subsequent signal to be transmitted from the respective one of the one or more remote communication terminals to the first communication terminal.

5 17. The device of Claim 16 wherein a respective signal received from a respective one of the one or more remote communication terminals was transmitted using a respective one of the plurality of rates and wherein the respective rate that satisfies a respective target channel condition metric comprises a different one of the plurality of rates, wherein the rate and power 10 control module additionally performs the following step:

 measuring a channel condition metric corresponding to each received signal; and

15 setting the respective rate to the respective one of the plurality of rates rather than the different one of the plurality of rates, in the event the measured channel condition metric for the respective received signal is within a hysteresis threshold of the target channel condition metric and in the event the system has been transmitting using the respective one of the plurality of rates for less than a specified number of iterations of the receiving and determining steps.

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 18. The method of Claim 16 wherein the determining step performed by the rate and power control module comprises:

25 solving, for each of the one or more remote communication terminals, the following equations for the respective transmit power level $p_i(n+1)$ and the respective rate $r_i(n+1)$ to be used by the respective one of the one or more remote communication terminals for the respective subsequent signal to be transmitted from the respective one of the one or more remote communication terminals to the first communication terminal:

$$p_i(n+1) = \max_{k \in \{1, \dots, L\}} \left\{ p_i(n) \frac{\gamma_i^k}{\gamma_i(n)} \mid \forall k : p_i(n) \frac{\gamma_i^k}{\gamma_i(n)} < p_{\max} \right\}$$

and

$$r_i(n+1) = \max_{k \in \{1, \dots, L\}} \left\{ r_i^k \mid p_i(n) \frac{\gamma_i^k}{\gamma_i(n)} < p_{\max} \right\}$$

5 where γ_i^k is the target channel condition metric for a given remote communication terminal, $\gamma_i(n)$ is the measured channel condition metric for a signal received from the given remote communication terminal, $p_i(n)$ is a transmit power level of the received signal from the given remote communication terminal, i is a terminal index of the one or more remote 10 communication terminals, where $i=1,2,3,\dots,I$, where $I \geq 1$ and is a total number of the one or more remote communication terminals, k is a rate index where $k=1, 2, 3, \dots, K$, where K is a total number of the plurality of rates, and L is a highest rate of the plurality of rates supportable during the n^{th} iteration.

15 19. The device of Claim 16 further comprising a transmitter coupled to the rate and power control module for transmitting the respective transmit power level and the respective rate for each of the one or more remote communication terminals to the respective one of the one or more remote communication terminals.

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20. The device of Claim 16 wherein the adjusting step performed by the rate and power control module comprises:
reducing the respective assigned target channel condition metric for the respective one of the one or more remote communication terminals in 25 the event the respective transmit power level exceeds a maximum transmit power of the respective one of the one or more remote communication terminals.

21. The device of Claim 16 wherein the adjusting and determining steps performed by the rate and power control module are performed at the first communication terminal, wherein the first communication terminal and the one or more remote communication terminals comprise a cell within a communication system comprising a plurality of cells, wherein the rate and power control module performs the adjusting and determining steps independent of rate and power adjustments made in others of the plurality of cells in the communication system, wherein a distributed rate and power control algorithm is provided.

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22. The device of Claim 14 further comprising a receiver of the first communication terminal, the rate and power control module coupled to the receiver.

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23. The device of Claim 14 wherein the adjusting step performed by the rate and power control module comprises:
adjusting the respective assigned target channel condition metric in response to the signal information generated from the received signal from the respective one of the one or more remote communication terminals, the signal information comprising one or more of a group consisting of: a measured channel condition metric corresponding to the received signal, a measured received signal strength of the received signal, and the results of an error detection process performed on the received signal.

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24. The device of Claim 14 wherein the adjusting step performed by the rate and power control module comprises:
reducing the respective assigned target channel condition metric in the event a measured received signal strength of the received signal from the respective one of the one or more remote communication terminals exceeds a threshold received signal strength of the first communication

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terminal.

25. The device of Claim 24 further comprising:
 - 5 a channel condition metric estimation module coupled to the rate and power control module for measuring a channel condition metric corresponding to each received signal and for measuring a received signal strength for each received signal.
- 10 26. The device of Claim 14 wherein the adjusting step performed by the rate and power control module comprises:
 - 15 reducing the respective assigned target channel condition metric in the event an error detection process indicates that there is an error in the received signal from the respective one of the one or more remote communication terminals.
- 15 27. The device of Claim 14 wherein the adjusting step performed by the rate and power control module comprises:
 - 20 increasing the respective assigned target channel condition metric in the event an error detection process indicates that there are no errors in the received signal from the respective one of the one or more remote communication terminals.
- 25 28. The device of Claim 14 wherein at least two of the one or more remote communication terminals supports a different one of a plurality of types of service.

29. A rate and power control system in a communication system comprising:

means for assigning a target channel condition metric to be met at a first communication terminal for signaling received from each of one or more remote communication terminals of the communication system, each communication terminal supporting a plurality of rates and a plurality of transmit power levels, each target channel condition metric based upon the type of service supported by each of the one or more remote communication terminals,

10 means for receiving a signal at the first communication terminal from each of the one or more remote communication terminals; and

15 means for adjusting a respective target channel condition metric assigned for a respective one of the one or more remote communication terminals in response to signal information generated from the received signal from the respective one of the one or more remote communication terminals.

30. The system of Claim 29 further comprising means for determining a respective transmit power level and a respective rate that will satisfy the target channel condition metric for each of the one or more remote communication terminals, the respective transmit power and the respective rate to be used by a respective one of the one or more remote communication terminals for a respective subsequent signal to be transmitted from the respective one of the one or more remote communication terminals to the first communication terminal.

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31. The system of Claim 30 further comprising means for transmitting the respective transmit power level and the respective rate for each of the one or more remote communication terminals to the respective one of the one or more remote communication terminals.

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